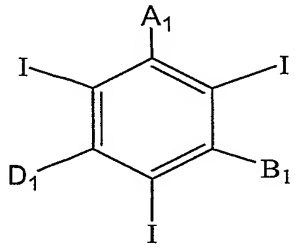
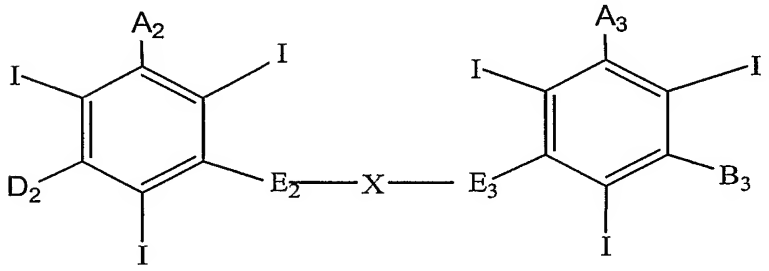
CLAIMS

What is claimed is:

1. An injectable radiological composition for x-ray visualization during radiological examinations, the composition comprising a pharmaceutically acceptable vehicle and a mixture of at least one monomer and at least one dimer, the monomer corresponding to Formula I and the dimer corresponding to Formula II



Formula (I)



Formula (II)

wherein

A_1, B_1, and D_1 are independently $-CON(R_3)R_1$ or $-N(R)C(O)R_2$;

A_2, A_3, B_3, and D_2 are independently $-CON(R)R_1$ or $-N(R)C(O)R_2$ provided, however, at least one of A_2 and A_3 is $-CONH_2$;

E_2 and E_3 are independently selected from the group consisting of $-CON(R)-$, $-N(R)C(O)-$ and $-N(COR_2)-$;

each R is independently H, a linear or branched (C_1 - C_8) alkyl residue, optionally substituted by one or more hydroxy, alkoxy or hydroxyalkoxy groups or combinations thereof, or a member of a (C_3 - C_7) cyclic residue, said cyclic residue being optionally interrupted by -O-, -S- or $-NR_4-$, and/or optionally substituted with one or more hydroxy, alkoxy or hydroxyalkoxy groups or combinations thereof, the cyclic residue comprising R, the nitrogen atom to which

it is bonded and another moiety, that moiety being (i) -C(O)R_2 when A_1, A_2, A_3, B_1, B_3, D_1 or D_2 is -N(R)C(O)R_2 or (ii) R_1 when A_2, A_3, B_3, or D_2 is -CON(R)R_1;

each R_1 is independently (i) hydrogen, (ii) a linear or branched (C_1 - C_8) alkyl residue, optionally substituted with one or more hydroxy, alkoxy, hydroxyalkoxy groups or combinations thereof or by -NRC(O)R_1 or -C(O)N(R)R_1, (iii) the residue of a carbohydrate, or (iv) a member of a (C_3 - C_7) cyclic residue, said cyclic residue being optionally interrupted by -O-, -S- or -NR_4-, and/or optionally substituted by one or more hydroxy, alkoxy or hydroxyalkoxy groups or combinations thereof, the cyclic residue comprising R_1, the nitrogen atom to which it is bonded and another moiety, that moiety being (a) R when A_2, A_3, B_3, or D_2 is -CON(R)R_1 or (ii) R_3 when A_1, B_1, and D_1 is -CON(R_3)R_1;

each R_2 is independently (i) a linear or branched (C_1 - C_8) alkyl residue, optionally substituted with one or more hydroxy, alkoxy or hydroxyalkoxy groups, or combinations thereof or (ii) a member of a (C_3 - C_7) cyclic residue, said cyclic residue being optionally interrupted by -O-, -S- or -NR_4- and/or optionally substituted with one or more hydroxy, alkoxy or hydroxyalkoxy groups or combinations thereof, the cyclic residue comprising R_2, R, the nitrogen atom to which R is bonded and the carbonyl moiety to which R_2 is bonded;

each R_3 is independently linear or branched (C_1 - C_8) alkyl residue, optionally substituted with one or more hydroxy, alkoxy or hydroxyalkoxy groups or combinations thereof, or taken together with R_1 and the nitrogen atom to which R_3 and R_1 are bonded, form a (C_3 - C_7) cyclic residue, said cyclic residue being optionally interrupted by -O-, -S- or -NR_4-, and/or optionally substituted by one or more hydroxy, alkoxy or hydroxyalkoxy groups or combinations thereof;

each R_4 is independently hydrogen or a linear or branched (C_1 - C_8) alkyl residue, optionally substituted with one or more hydroxy, alkoxy, hydroxyalkoxy groups or combinations thereof; and

X is a bond or a linear or branched (C_1 - C_8) alkylene chain which is optionally substituted by up to six hydroxy groups, said alkylene chain being optionally interrupted by -O-, -S-, -NR_4- or -N(R)C(O)- groups.

2. The composition of claim 1 wherein A_2 and A_3 are independently -C(O)NH_2.

3. The composition of claim 1 wherein X is methylene.

4. The composition of claim 1 wherein A_1 and B_1 are -C(O)N(R_3)R_1, and each R_3 and R_1 of A_1 and B_1 are as defined in claim 1.

5. The composition of claim 4 wherein D_1 is -N(R)C(O)R_2, and R and R_2 are as defined in claim 1.

6. The composition of claim 1 wherein A_1 and B_1 are -CONHR_3 wherein each R_3 of A_1 and B_1 is independently methyl, hydroxymethyl, ethyl, hydroxyethyl, propyl, hydroxypropyl, or dihydroxypropyl.

7. The composition of claim 6 wherein D_1 is -N(R)C(O)R_2, and R and R_2 are as defined in claim 1.

8. The composition of claim 1 wherein A_1 and B_1 are –CONR_1R_3 wherein each R_1 and R_3 of A_1 and B_1 is independently methyl, hydroxymethyl, ethyl, hydroxyethyl, propyl, hydroxypropyl, or dihydroxypropyl.

9. The composition of claim 8 wherein D_1 is -N(R)C(O)R_2, and R and R_2 are as defined in claim 1.

10. The composition of claim 1 wherein D_1 is -N(R)C(O)R_2, and the R and R_2 substituents of D_1 are independently methyl, hydroxymethyl, ethyl, hydroxyethyl, propyl, hydroxypropyl, 1-methoxy-2-hydroxypropyl, or dihydroxypropyl.

11. The composition of claim 10 wherein A_1 and B_1 are -CONHR_3 wherein each R_3 of A_1 and B_1 is independently methyl, hydroxymethyl, ethyl, hydroxyethyl, propyl, hydroxypropyl, or dihydroxypropyl.

12. The composition of claim 10 wherein A_1 and B_1 are –CONR_1R_3 wherein each R_1 and R_3 of A_1 and B_1 is independently methyl, hydroxymethyl, ethyl, hydroxyethyl, propyl, hydroxypropyl, or dihydroxypropyl.

13. The composition of claim 2 wherein at least one of A_1, B_1 and D_1 is $-CONR_1R_3$ wherein R_1 is hydrogen.

14. The composition of claim 2 wherein one of A_1, B_1 and D_1 is $-N(R)C(O)R_2$ and R and R_2 are as defined in claim 1.

15. The composition of claim 1 wherein the monomer is selected from the group consisting of iomeprol, iopromide, ioversol, iohexol, iopentol, iopamidol and iobitridol.

16. The composition of claim 1 wherein the dimer is iosmin.

17. The composition of claim 1 wherein the monomer is selected from the group consisting of ioversol, iohexol, and iopamidol, and the dimer is iosmin.

18. The composition of claim 1 wherein the monomer is ioversol and the dimer is iosmin.

19. The composition of claim 1 wherein the composition further comprises pharmaceutically acceptable radiological vehicles selected from the group consisting of aqueous buffer solutions, sterile water for injection, physiologic saline, balanced ionic solutions, chelating agents, and other non-radioactive additives comprising excipients and anticlotting agents.

20. The composition of claim 19 wherein said aqueous buffer solutions comprise tris(hydroxyethyl)amino methane and salts thereof, phosphate, citrate and bicarbonates; wherein said balanced ionic solutions comprise chlorides and bicarbonates of cations selected from the group consisting of Ca, Na, K, and Mg, and other halides, carbonates, sulphates, phosphates of Na, K, Mg and Ca; wherein said chelating agents consist of H_4EDTA, $EDTACaNa_2$ and calcium monosodium DTPA-BMEA; wherein said excipient is glycerol, polyethylene glycol or dextran; and wherein said anticlotting agent is heparin or hirudin.

21. The composition of claim 1 wherein the composition further comprises a contrast agent other than the monomer and the dimer.

22. The composition of claim 21 wherein said other contrast agent is selected from the group consisting of other X-ray contrast agents, magnetic resonance imaging agents, radionuclide imaging agents, ultrasound imaging agents and optical imaging agents.

23. A method of diagnostic imaging, the method comprising administering to an individual a composition of claim 1, and carrying out an imaging procedure on such individual.

24. The method of claim 23 wherein said composition comprises a monomer selected from the group consisting of ioversol, iohexol and iopamidol, and the dimer is iosimenol.

25. The method of claim 23 wherein said composition comprises a mixture of ioversol and iosimenol.

26. A method of diagnostic imaging, the method comprising administering to an individual a composition of claim 22, and carrying out an imaging procedure on such individual.